I. REMARKS/ARGUMENTS

3. The Office Action dated May 24, 2004 has been carefully considered. Reconsideration of this application, in view of the following remarks, is respectfully requested.

A. References

4. The following U.S. patents were relied on in the office action:

- US Patent 6,058,215 ("Schwartz"), filed April 30, 1997.
- US Patent 6,005,979 ("Chang et al."), filed January 13, 1997.
- US Patent 4,743,959 ("Frederiksen"), filed September 17, 1986.

B. Overview of Office Action

5. The office action:

a) Provided new grounds of rejection using new references.

b) Rejected claims 11-12, 14-15 as being obvious in light of Schwartz in combination with Chang under 35 U.S.C. 103(a).

c) Rejected claim 13 as being obvious in light of Schwartz and Chang in further combination with Frederiksen under 35 U.S.C. 103(a).

C. Claim Rejections under 35 U.S.C. 103(a)

6. The office action rejected claims 11-12 and 14-15 as being obvious in light of Schwartz in combination with Chang under 35 U.S.C. 103(a). Claim 13 is rejected in further view of Frederiksen under 35 U.S.C. 103(a).

D. Chang Does Not Teach Elements Referred to by the Office Action

7. The office action fails to present a clear argument why the claimed subject matter as a whole would have been obvious. Regarding claims 11, 14, and 15, the office action cites Chang teaching:

- A video digitizer at col 5, lines 5-8
- A video memory Fig 1, 101
- An encoding circuit Fig 1B with reference numerals 121 and 124.

However, Chang col 5, lines 5-8 does not disclose a video digitizer. Chang Fig 1 does not have a reference number 101 nor an element identified as a video memory. Further Chang does not have a Fig 1B.

8. The same references are also used in combination reject claims 12 and 13.

E. Schwartz Also Fails Teach What is Relied on by the Office Action

9. It appears that the office action may have confused Chang with Schwartz. However, even if the Office Action had cited Schwartz, the citations do not teach what the office action relies on for the combination to teach.

F. Schwartz Fig 1A 101 is Not a Video Memory

10. Schwartz does not have a Fig 1, but it does have a Fig 1A which has a reference numeral 101. However, Schwartz 101 is labeled "Compressor with reversible DCT" and is described as "a reversible DCT based compressor 101" (Schwartz 5:1-2). The Office Action relies on reference 101 to teach a video memory; however reference 101 is an entire block based compressor the detail of which is shown in Fig 1B.

G. Schwartz Fig 1B Does Not Teach Applicant's Encoding Circuit

11. Schwartz Fig 1B shows an encoding circuit composed of seven steps. The reference does not teach what the Office Action relies upon it as supposedly teaching. Schwartz does not clearly teach "a pixel value comprising a number of pixel bits sub-sampled from each pixel", rather Schwartz merely teaches "color space or subsampling block 121 which performs color space conversion or subsampling of the input data." (Schwartz 5:37-40) This does not

clearly teach the required limitation of "a pixel value comprising a number of pixel bits sub-sampled from each pixel". One of ordinary skill in the art would have understood this to refer to color space conversion from RGB to YCbCr where the resolution of the two chrominance components Cb and Cr is reduced, such as taught by Frederiksen where "a pair of chrominance components (R-Y) [Cr] and (B-Y)[Cb] for every four horizontal pixels in the image" is "then averaged so that a block is finally represented by two pairs of chrominance components" (Federiksen 5:64-6:13). This is not the same as sub-sampling a number of pixel bits for <u>each</u> pixel.

12. Further, Schwartz does not teach "outputting a series of encoded data comprising a combined run-length field and a data field". The Office Action cites reference numeral 124, which is labeled "Runlengths of zeros" and is described as "run length block 124 which identifies run lengths of zeros. The output of run length block 124 is coupled to the input of Huffman coder 125, which performs Huffman coding." (Schwartz 5:48-52). This is not the same as Applicant's encoded data that has a run-length field and a data field. In Schwartz because the run-lengths are of zeros there is no need to have a data field. In this regard, Schwartz teaches away from the present invention. Further, Schwartz teaches a Huffman coding step that occurs prior to outputting the encoded data. Further, applicant's invention omits many elements of Schwartz's compressor (namely, block averaging, the Discrete Cosine Transform (DCT), quantization, zig-zag, Huffman coding, and signaling), thus Applicant's invention is made simpler.

H. The Combination of Schwartz and Chang Does Not Teach Applicant's Encoding Circuit

13. The Office Action admits that Schwartz does not specifically disclose counting repeated instances of a pixel value comprising a number of pixel bits sub-sampled, and relies on Chang to teach the missing element. However Chang does not teach what the Office Action relies on it to teach.

14. Chang Fig 1, 3a, and 3b do not teach "counting repeated instances of a pixel value comprising a number of pixel bits sub-sampled from each pixel" as required by claim 11. As shown in Fig 1, 13 and 14', Chang teaches image sub-sampling, not pixel sub-sampling. The block labeled "subsample by n" (Fig 1, 13) is described as "subsampling block 13, in which the amount of data along each direction in the data array is reduced systematically by a factor n to produce a subsample 14" (Chang 8:39-42). On Fig 1, this is labeled "sub-sampled image" 14'. This image sub-sampling is shown in Fig 3a and 3b: "FIG. 3a is a hypothetical very small original image data array, FIG. 3b is a subsample of the FIG. 3a data, for a subsampling ratio of two" (Chang 8:16-18) and "For n=2 the system <u>retains data in only every other pixel</u>, in both directions of the array--so the subsample 14 (FIG. 3b) has just 2 rows x 3 columns=6 pixels, one quarter of the number (24) in the original image array 11. The <u>pixels in the subsample</u>--and the data for those pixels--<u>are identically</u> pixels aa, ac, ae, ca, cc, and ce." (Chang 15:34-39, emphasis added). Unlike the present invention where "<u>a number of pixel bits</u> sub-sampled from <u>each</u> pixel", Chang teaches that <u>all of the bits</u> from <u>only every other pixel</u> are retained. In this regard, Chang teaches away from the present invention.

15. Further, Chang does not teach "<u>counting repeated instances of a pixel value</u> comprising a number of pixel bits sub-sampled from each pixel" as required by claim 11.

Chang in Fig 1, 27 teaches a "classical run-length encoding (RLE) module 27". However, Chang does not teach "counting repeated instances of a pixel value". Instead, Chang teaches "correction information 26 only for pixels where correction is most needed" (Chang 10:36-38, emphasis added). This correction information 26 (also known as trim data) is not the same as applicant's "pixel value comprising a number of pixel bits sub-sampled from each pixel". Further, the array of correction information "consisting (unlike the original image array) primarily of zeroes, is then ideally suited for the previously mentioned classical run-length encoding (RLE)" (Chang 11:31-35, emphasis added). Like Schwartz, Chang's run-length encoding appears to be counting runs of zeros. Thus, neither Schwartz, Chang, nor the proposed combination suggest "counting repeated instances of a pixel value comprising a number of pixel bits sub-sampled from each pixel" or "encoded data comprising a combined run-length field and a data field" as required by claim 11.

16. Further, applicant's invention omits many elements of Chang's compressor (namely, image sub-sampling13, bileanear interpolation 15/31, residual calculation 23, and adaptive thresholding 25), thus Applicant's invention is made simpler.

I. **The Combination of Schwartz and Chang is Improper**

17. Schwartz and Chang do not contain any suggestion that they be combined, especially in the manner suggested. Further, the references are individually complete so there would be no reason to use parts from or to add or substitute parts to any reference. The references take different overall approaches to solving the compression problem; since they teach away from each other, it would not be logical to combine them. Further, as discussed above, the references teach away from the suggested combination (see discussion above regarding "every other pixel", "runs of zeros", and "data field")

18. Finally, even if the Schwartz and Chang were combined as suggested, the combination would not meet the limitations of the claims, such as "counting repeated instances of a pixel value comprising a number of pixel bits sub-sampled from each pixel" or "encoded data comprising a combined run-length field and a data field" as required by claim 11(c), as discussed above. Thus, the combination still lacks the claimed feature.

Applicant's Invention

19. Applicant's invention is a simple, fast, effective, on-the-fly, one-pass, clinically lossless way of compressing a video signal. As pixels are digitized and received into a video memory, the present invention is able to extract a pixel value by sub-sampling a predetermined number of bits from each pixel, and then count repeated instances of that bit-wise sub-sampled value. The encoding circuit is able to do this in one pass, on-the-fly, "when scanning" and outputs a data code for each run of extracted pixel values. While not a limitation of claim 11 as currently amended, an embodiment of this invention could hypothetically output encoded data as soon as two or more pixels were digitized. This is much different than the methods and apparatus taught by the cited references, performs many different steps and takes different approaches. The present invention eliminates many steps found in the cited art and is able to provide clinically lossless results that cannot be achieved by the prior art.

J. Claims 11, 14, and 15 Not Rendered Obvious by Schwartz and Chang

20. As discussed above, neither Schwartz, Chang, nor their combination teach the elements of the present invention. Neither Schwartz or Chang *as cited by the Office Action* teaches a video memory as required by claim 11(b). Neither Schwartz, Chang, or the suggested combination teach "an encoding circuit for counting repeated instances of a pixel value comprising a number of pixel bits sub-sampled from each pixel when scanning said plurality of

pixels and outputting a series of encoded data comprising a combined run-length field and a data field" as required by claim 11(c).

21. Further, Schwartz and Chang teach away from counting repeated instances of a bit-wise sub-sampled value <u>when scanning</u>. The present invention omits many elements of the cited prior art, makes compression faster and simpler and results in superior image quality. The present invention goes against the grain of prevailing discrete cosign transform (DCT) compression techniques taught by the prior art. Products incorporating the present invention have been licensed and used by hospitals in the University of California system. The present invention provides many unexpected results or unappreciated advantages over the prior art as outlined in the "Objects and Advantages" section of the specification. Thus, neither Schwartz, Chang, nor their combination render the claims obvious.

K. Claims 12 Not Rendered Obvious by Chang

22. Claim 12 is a dependent claim, and, for all the reasons stated above with respect to independent claim 11, should be patentable over Chang.

23. As cited by the Office Action, Chang discloses RGB pixels where each color red, green, and blue is represented by eight bits in a 24-bit pixel (see Chang 1:33-43). However, teaching a 24-bit pixel does not teach "a pixel value comprising <u>a number of pixel bits sub-sampled</u> from each pixel". As discussed above, Chang's disclosure is not the same as Applicant's <u>*sub-sampling*</u> "a number of pixel bits" because all 24 bits are preserved for the selected pixels, and all eight bits for each component are preserved (see Chang Fig 3a and 3b). For example, "[a]s shown, each pixel has three associated eight-bit data values; these may be considered as corresponding to the three primary lights red, green and blue respectively. … In pixel aa for example the red level is 253, the green 18 and the blue 92" (Chang 15:13-19). In

Applicant's invention, if the pixel had 24 bits, a *bit-wise sub-sampled* pixel value would be *less than* 24 bits, and if the pixel had 8 bits, a bit-wise sub-sampled pixel would have *less than* 8 bits. For example, Applicant's Fig 3A shows a 5-bit pixel value being sub-sampled from an 8-bit pixel and Fig 1380a shows a "24 to 5 bit sub-sampler". Chang does not disclose 8 as "the number of pixel bits [sub-sampled from each pixel]" but rather 8 as the number of bits for each of the three components. All 24 bits are still preserved, because there is no bit-wise *sub-sampling*. The cited reference does not teach bit-wise *sub-sampling to reduce the number of bits* in a pixel value as required by claim 11 and its dependent claim 12.

24. Further, Chang teaches away from bit-wise sub-sampling to obtain a smaller number of bits. Thus, Chang does not render claim 12 obvious.

L. Claims 13 Not Made Obvious by Schwartz, Chang, and Frederiksen

25. Claim 13 is a dependent claim, and, for all the reasons stated above with respect to independent claim 11, should be patentable over the suggested combination of Schwartz and Chang.

26. Frederiksen does not teach "a pixel value comprising a number of pixel bits sub-sampled from each pixel" (claim 11(c)) "wherein said pixel value is extracted from the most significant bits of each color component" (claim 13). Instead, Frederiksen teaches a median luminance value (derived from a plurality of pixels) and average chrominance values (also derived from a plurality of pixels) (see, Frederiksen 7:58-62). Even if Frederiksen were combined with Schwartz and Chang, the combined teachings would still not meet the limitations as set forth in claim 13 (and claim 11 upon which it depends). It would still require a modification not suggested by any of the references.

27. As stated above, Schwartz and Chang do not teach bit-wise sub-sampling to extract a subset of bits as the pixel value. Because Schwartz and Chang do not teach extraction of a smaller number of bits, it would not be obvious to combine Frederiksen's extraction of the most significant bits of each color component with Schwartz and Chang. There is no teaching or motivation to combine. Both references are complete in themselves and take mutually exclusive paths. Further, Frederiksen was published in 1988 and was available to both Schwartz and Chang, yet neither chose to adopt Frederiksen's approach. Even if the references were combined, the combination would not result in Applicant's invention. The resulting combination would still take a much different, conventional approach to video compression, would include many elements omitted by the present invention, and would not have the resulting clinically lossless quality of the present invention. Thus, Schwartz and Chang in view of Frederiksen do not render claim 13 obvious.

II. Among Crowded Art, Applicant's Invention Provides a New Principle of Operation

28. As can be seen by the many references cited and overcome to date in this application, there is crowded art where even small steps in the area of block transform based compression techniques have been regarded as patentable. Applicant's invention blazes a new trail, rather than following the crowd and their standard block based, transform based approaches. Applicant's invention instead is a simple, fast, effective, on-the-fly, one-pass, clinically lossless way of compressing a video signal. As pixels are digitized and received into a video memory, the present invention is able to extract a pixel value by sub-sampling a predetermined number of bits from each pixel, and then count repeated instances of that bit-wise sub-sampled value. The encoding circuit is able to do this in one pass, on-the-fly, "when scanning" and outputs an data code for each run of extracted pixel values. The present invention

eliminates many steps found in the cited art and is able to provide clinically lossless results that cannot be achieved by the prior art.

III. Reconsideration Requested

29. The undersigned respectfully submits that, in view of the foregoing remarks, the rejections of the claims raised in the Office Action have been fully addressed and overcome, and the present application is believed to be in condition for allowance. It is respectfully requested that this application be reconsidered, that these claims be allowed, and that this case be passed to issue. If it is believed that a telephone conversation would expedite the prosecution of the present application, or clarify matters with regard to its allowance, the Examiner is invited to call the undersigned inventor at 408-739-9517.

Respectfully submitted,

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Sunnyvale, CA
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